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NOTES ON GEOGRAPHIC DISTRIBUTION

Westernmost range boundary and first records of *Dryophylax hypoconia* (Cope, 1860) (Serpentes, Dipsadidae) from Bolivia

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Abstract. We present the first records of *Dryophylax hypoconia* (Cope, 1860) from Bolivia and discuss its range in South America. These are currently the westernmost records of this species and extends the known western range by ~900 km from the nearest known range boundary. There is a lack of information for *D. hypoconia* in the scientific literature, which is largely due to limited sampling across South America and taxonomic uncertainties within this taxon. Our report contributes to the distributional knowledge of this species and summarizes available data from the Bolivian portion of its range.

Key words. Beni floodplains, Bolivian Cerrado, distribution, geographic range

Eversole CB, Rivas LR, Powell RL, Wallace RB (2025) Westernmost range boundary and first records of *Dryophylax hypoconia* (Cope, 1860) (Serpentes, Dipsadidae) from Bolivia. Check List 21 (2): 413–419. https://doi.org/10.15560/21.2.413

INTRODUCTION

The genus *Dryophylax* Wagler, 1830 includes 15 species of snakes widely distributed across the South America, from the Caribbean coast of Colombia and Venezuela, south to Argentina and along the Atlantic coast of South America (Trevine et al. 2021, 2022; Uetz et al. 2024). It was formerly included in the genus *Thamnodynastes* Wagler, 1830; however, based on molecular and morphological data, Trevine et al. (2022) determined *Thamnodynastes* to be non-monophyletic, resulting in a new systematic arrangement and revalidation of the genus *Dryophylax*. Across their range, species of *Dryophylax* occur in many different terrestrial environments and habitats, including humid and xeric conditions, along different altitudinal gradients; and exhibit both diurnal and nocturnal habits (Bellini et al. 2013, 2014; Rivas et al. 2024).

Dryophylax hypoconia (Cope, 1860) [syn. *Thamnodynastes hypoconia* (Cei, Bergna, & Alvarez 1992); Trevine et al. 2022] has one of the widest distributions in South America and is known to occur along the Atlantic coast from eastern Brazil, through Paraguay, Uruguay, and northern Argentina (Nogueira et al. 2019; Trevine et al. 2021, 2022). This taxon corresponds to a species complex, with at least four different lineages currently assigned within the species (Trevine et al. 2022). Although the known range of *D. hypoconia* occurs close to the eastern borders of Bolivia, the presence of this species has not been previously recorded for the country (Eversole et al. 2024). In addition to its distribution and geographic range, there is also limited information available on the general natural history and ecology of this species, especially in underreported parts of its range.

Here, we report on recently collected specimens that represent the first records of *Dryophylax hypoconia* from Bolivia. Specimen collection was approved and permitted by the Dirección General de Biodiversidad y Áreas Protegidas Bolivia (permit #0120/2022).

OPEN ACCESS

Academic editor: Raúl Maneyro
Received: 17 February 2025
Accepted: 21 March 2025
Published: 8 April 2025

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METHODS

During herpetofaunal surveys in the department of Beni, Bolivia, we collected four adult *Dryophylax hypoconia* individuals. These were collected by hand and deposited into the Colección Boliviana de Fauna (CBF) of the Museo de Historia Natural and the herpetological collection of the Centro de Investigación de Recursos Acuáticos (CIRAH) at the Universidad Autónoma del Beni José Ballivián, following the methodology by Cacciali (2013) and Eversole et al. (2019).

The specimens were fixed in a 20% formalin solution and preserved in a 70% ethanol solution. We georeferenced the collection locations in decimal degrees using a Garmin eTrex GPS receiver and generated a point map using ArcGIS software (ArcPro v. 3.3).

Following collection, we photographed each specimen and recorded morphometric measurements. Scale counts and scutellation terminology followed Dowling (1951) and Peters (1964). Head-scale counts (i.e. loreal, preocular, postocular, supralabials, infralabials, and temporal) were reported for both sides (right/left). Dorsal scale-row counts were taken at three standardized locations: head length behind occiput, midbody, and head length anterior to cloaca; these are separated by a dash (–). We assessed and included ventral, subcaudal (single row counting) and cloacal scale counts. We obtained measurements of snout–vent length (SVL) and tail length (TL) in millimeters (mm) using a flexible tape measure. Specimens were weighed using an Ohaus model HH 320 electronic balance. Sex was determined by injection of the subcaudal region following the methodology outlined by Simmons (2002).

Specimen identification was determined by comparing and analyzing meristic data, morphometrics, coloration, figures, photographs, and descriptions, following Trevine et al. (2021, 2022). In addition, identification was confirmed by a species expert (V. Trevine, personal communication).

RESULTS

Dryophylax hypoconia (Cope, 1860)

Figures 1–5

New records. BOLIVIA – Beni • Yacuma Province, municipality of Exaltación, around Lago Guachuna, found alive in the grasslands of the palm groves that surround the lake in the Cerrado, ca. 150 m elev.; –13.1250, –065.7011; 04.IX.2021; L.R. Rivas leg.; 20:32h, 1♀, CBF 4648 • 4.05 km NE of Lago Guachuna, found alive in the bushes on the edge of the riparian forest in the Cerrado (Los Sapos), ca. 161 m elev.; –13.0847, –065.6802; 11.IX.2021; L.R. Rivas leg.; 21:45h, 1♀, CBF 4649 • Cercado Province, municipality of Trinidad, 3.23 km SE of the city of Santísima Trinidad on the road to Laguna Suárez, found alive on asphalt road near riparian area and shallow water wetland within the Beni floodplain, ca. 157 m elev.; –14.8591, –064.8873; 25.VII.2024; C.B. Eversole, L.R. Rivas, R.L. Powell leg.; 22:00h, 1♂, CIRAH-1486. • Near Laguna Suárez to 5.31 km SE of the city of Trinidad, found alive in riparian area and shallow water wetland within the Beni floodplain, ca. 157 m elev.; –14.875064, –064.876916; 04.IX.2024; L.R. Rivas, M.A. Camacho leg.; 19:56h, 1♂, CIRAH-1495.

Identification. SVL = 261–452 mm, TL = 86–148 mm (Table 1). The diagnostic characters and coloration pattern of all specimens are consistent with the description of the species by Trevine et al. (2021, 2022) (Table 1).

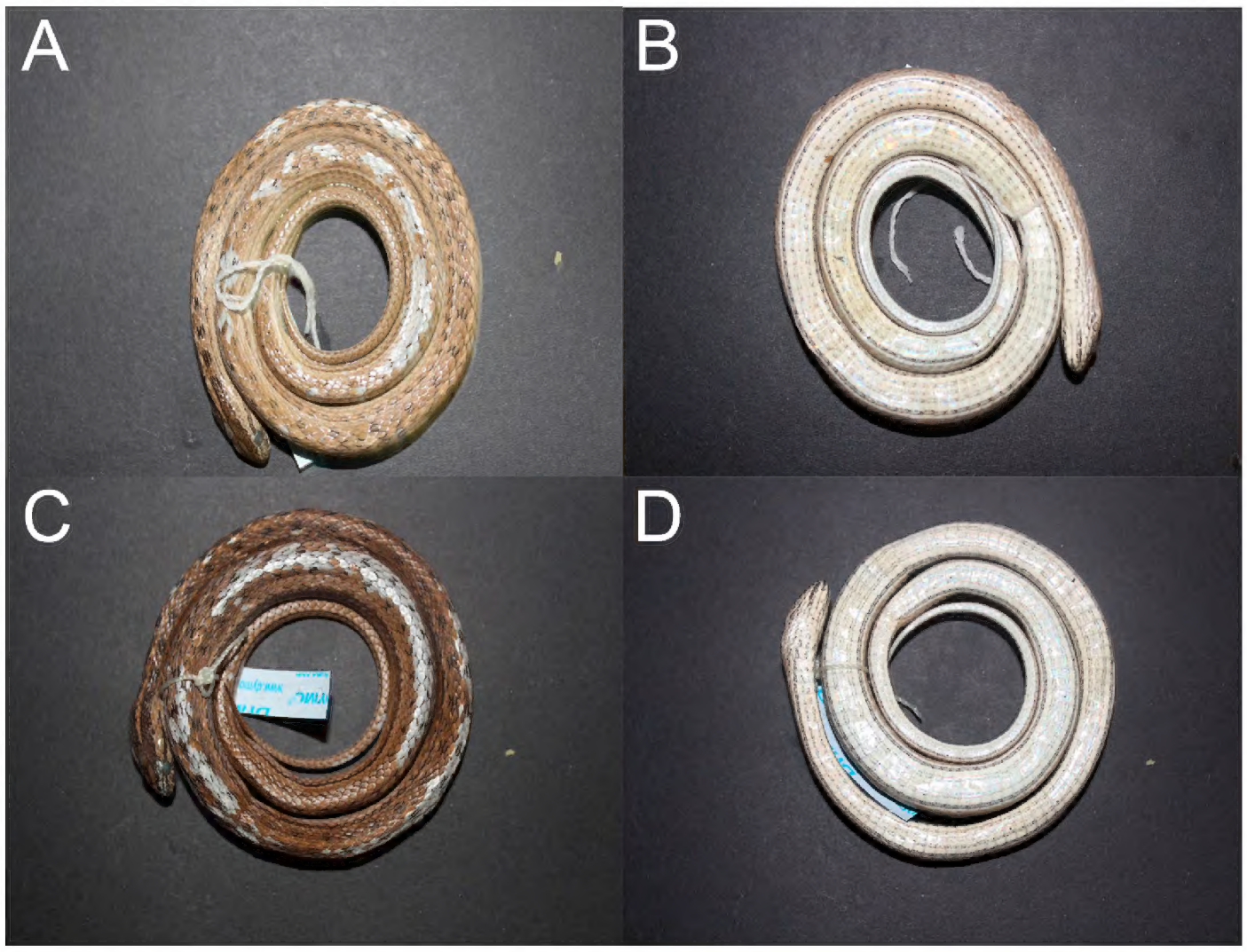

Figure 1. Dorsal and ventral view of *Dryophylax hypoconia* specimens from the Bolivian Cerrado. **A.** Dorsal view of CBF 4648. **B.** Ventral view of CBF 4648 (SVL= 261mm). **C.** Dorsal view of CBF 4649. **D.** Ventral view of CBF 4649 (SVL = 370 mm).

Figure 2. Example of habitat present in the Bolivian Cerrado at collection site of *Dryophylax hypoconia* specimens (CBF 4648-9).

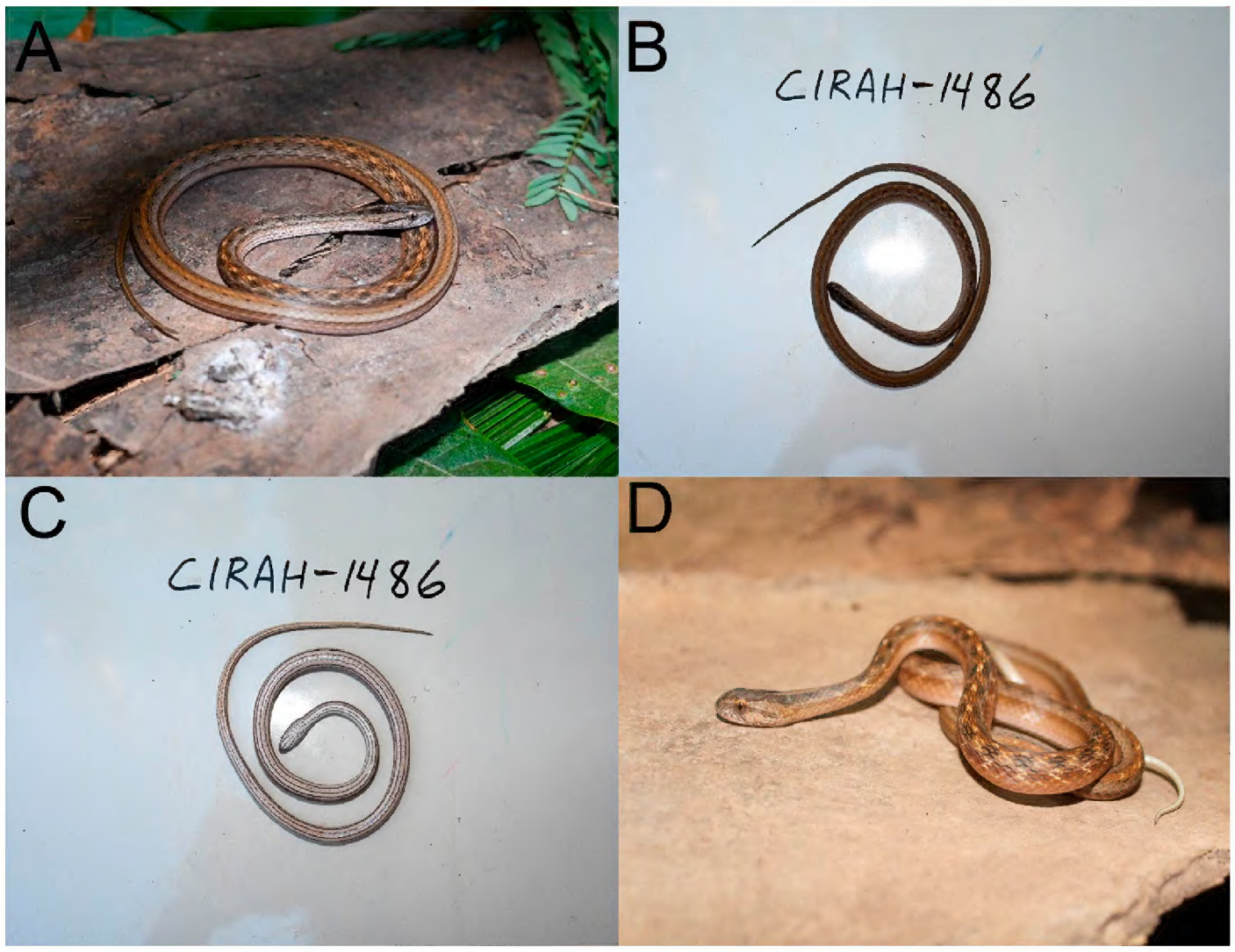

Figure 3. Dorsal, ventral, and live photos of *Dryophylax hypoconia* specimens from the Beni floodplains, Bolivia. **A.** Live photo of CIRAH-1486. **B.** Dorsal view of CIRAH-1486. **C.** Ventral view of CIRAH-1486 (SVL = 452mm). **D.** Live photo of CIRAH-1495 (no post-processing photos available; SVL = 338mm)).

Figure 4. Example of habitat present in the Beni floodplain at collection site of *Dryophylax hypoconia* specimens (CIRAH-1486, 1495).

Figure 5. Map of *Dryophylax hypoconia* distribution in South America (green; adapted from Nogueira et al. 2019) and novel records (CIRAH-1486, 1495, CBF 4648, 4649) from Bolivia (yellow stars).

DISCUSSION

This study documents the first confirmed records of *Dryophylax hypoconia* in Bolivia, expanding the westernmost known geographic range of the species by approximately 900 km from the nearest range boundary in southern Mato Grosso, Brazil (Nogueira et al. 2019). *Dryophylax hypoconia* has previously been reported from neighboring countries such as Brazil and Argentina, but its presence in Bolivia, and more specifically in the department of Beni, has not been previously documented (Nogueira et al. 2019; Eversole et al. 2024). Our novel records indicate that the species' range likely extends across a broader portion of South American ecosystems than previously recognized.

The presence of *D. hypoconia* in Bolivia suggests that this species can inhabit a wider geographic range than what has been previously documented and understood. However, the site where the individuals (CIRAH-1486 and 1495) were captured near Trinidad lies in a mosaic of humid lowland forest and riparian environments within the Beni floodplain, which is consistent with the known habitat preferences of this species (Bellini et al. 2013, 2014). The two specimens from near Exaltación were found near the shore of Lake Guachuna (CBF 4648) and in a riparian forest near a dry streambed (CBF 4649). The apparent association of *D. hypoconia* with these habitats highlights the potential for additional undocumented populations in similar forested regions of Bolivia and other areas of the Neotropics. This also highlights the importance of conservation in South America, which can be implemented to conserve the range of habitats occupied by a given species as a strategy to maintain their full landscape scale ecological niche (Zarzo-Arias et al. 2023). Future surveys are needed to continue to document the distribution of this species, as well as other underreported species from poorly studied regions such as Bolivia. Studies such as these can improve and refine our understanding of distributional limits and aid scientists in better understanding the species' true ecological niche. Additionally, these new records of *D. hypoconia* contribute to the idea that Bolivia serves

Table 1. Meristic and scutellation characters of *Dryophylax hypoconia* specimens (CIRAH-1486, 1495; CBF 4648, 4649) from Beni, Bolivia, compared with data presented by Franco et al. (2017), Trevine et al (2021) and Cope (1860). Snout–vent length (SVL, mm) and tail length (TL, mm); SL, supralabials; IL, infralabials; *, maximum; —, no data.

	CIRAH–1486	**CIRAH–1495**	**CBF 4648**	**CBF 4649**	**Trevine et al. 2021**		**Franco et al. 2017**		**Cope 1860**
Sex	Male	Male	Female	Female	Male	Female	Male	Female	–
SVL	452	338	261	370	556*	522*	556 (max)	522 (max)	–
TL	148	118	86	122	182*	167*	–	–	–
Dorsals	19–19–15	19–19–15	19–19–15	19–19–15	19–19–15	19–19–15	19/19/15	19/19/15	19–19–?
Ventrals	161	158	149	147	137–165	134–159	137–165	134–159	140
Subcaudals	76	80	71	71	60–87	61–80	60–87	61–80	52
Cloacal	Divided	Divided	Divided	Divided	—	—	–	–	Divided
Loreal	1/1	1/1	1/1	1/1	—	—	–	–	–
Preocular	1/1	1/1	1/1	1/1	1	1	—	—	—
Postocular	2/2	2/2	2/2	2/2	2	2	—	—	—
Temporal	2+3+5/2+3+5	2+3+4/2+3+4	2+3+5/2+1+3	2+3+5/2+2+3	—	—	—	—	—
Supralabials (SL)	8/8	8/8	8/8	8/8	—	—	8	8	8
SL contact orbit	4–5/4–5	4–5/4–5	4–5/4–5	4–5/4–5	—	—	–	–	–
Infralabials (IL)	9/9	9/9	9/9	9/9	—	—	9	9	9
IL contact first pairs of chin–shields	1–5/1–5	1–5/1–4	1–5/1–5	1–5/1–5	—	—	—	—	—
IL contact second pairs of chin–shields	5/5	5/4	5/5	5/5	—	—	—	—	—
Dorsal scales	Keeled	Keeled	Keeled	Keeled	Keeled	Keeled	Keeled	Keeled	—
Ventral stripes	4	4	5	5	2–6	2–6	2–6	2–6	–
Apical pit	1	1	1	1	1	1	—	—	—

as a biogeographic crossroads for a wide range of neotropical fauna due to its ecological diversity at the landscape scale. Rigorous documentation of biodiversity in this area will continue to provide evidence of a complex faunal interchange between the numerous unique ecotypes present in the country.

Bolivia has experienced high rates of forest loss in recent years, particularly in the lowland areas where these individuals were found. Although the conservation status of *D. hypoconia* is currently listed as Least Concern by the IUCN, habitat destruction may pose an unrecognized threat to local populations of *D. hypoconia*, especially if the species exhibits habitat relationships or specialization not yet fully understood. However, because these individuals were found in a relatively disturbed area, this species may be more resilient to ecological change than other species in the neotropics. As such, continued monitoring of *D. hypoconia* and other herpetofauna populations in Bolivia as part of broader conservation efforts is necessary to fully understand ecological interactions and better implement conservation and management action.

Our findings highlight the importance of continued field surveys and biological inventories in underexplored regions of Bolivia. Herpetological research in this area is limited, and future surveys will undoubtedly result in additional unrecorded or cryptic species. Data and information such as these are imperative in providing more precise estimates of species boundaries which are necessary in understanding the full extent of species natural history and roles at higher spatial and ecological scales.

ACKNOWLEDGEMENTS

We thank the Grupo de Trabajo para los Llanos de Moxos, the Wildlife Conservation Society and the Gordon and Betty Moore Foundation for support and participation in the Expedición a los Grandes Lagos Tectónicos de Exaltación, the Centro de Investigación de Recursos Acuáticos and Universidad Autónoma del Beni José Ballivián and the Project "Identificación y caracterización de comunidades animales y vegetales en el Complejo Turístico Laguna Suarez, Trinidad, Beni, Bolivia" for logistical support and for providing field transportation, the Dirección General de Biodiversidad y Áreas Protegidas for granting research and collection permits CAR/MMAYA/VMABCCGDF/DGBAP/UGCE N° 538/2023, Vivian Trevine for confirming the identity of the specimens of *D. hypoconia* from Bolivia, Miguel Angel Camacho for field assistance, and Idea Wild for the purchase of some field equipment used in this study.

ADDITIONAL INFORMATION

Conflict of interest

The authors declare that no competing interests exist.

Ethical statement

No ethical statement is reported.

Author contributions

Conceptualization: CBE, LRR, RLP. Data curation: CBE, LRR, RLP. Formal analysis: CBE, LRR, RLP. Funding acquisition: CBE, RLP, RBW, LRR. Investigation: CBE, LRR, RLP. Methodology: CBE, LRR, RLP. Visualization CBE. Project administration: CBE, LRR, RLP, RBW. Writing – original draft: CBE. Writing – review and editing: CBE, LRR, RLP, RBW.

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Data availability

All data that support the findings of this study are available in the main text.

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